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THE HISTORY AND DEVELOPMENT OF THE WATER SUPPLY OF ARLINGTON COUNTY, VIRGINIA.

by

Thomas P. Wharton

4/13/38

A thesis presented as a requirement for initiation into the Maryland Beta of Tau Beta Pi

SUMMARY

Arlington County's water supply actually dates back to November 8, 1853, when the Washington Aqueduct was begun by order of Congress. This was even before Abraham Lincoln had reached fame. On December 5, 1863, in the same year that Lincoln's Emancipation Proclamation took effect and only a few weeks after his famous Gettysburg Address, water was delivered to residents of Washington from Great Falls of the Potomac River through a huge nine-foot conduit. Developments and improvements of the Washington Aqueduct have continually been made, and it was only recently that the United States Government was engaged in an "Increasing the Water Supply" program from 1921 to 1927.

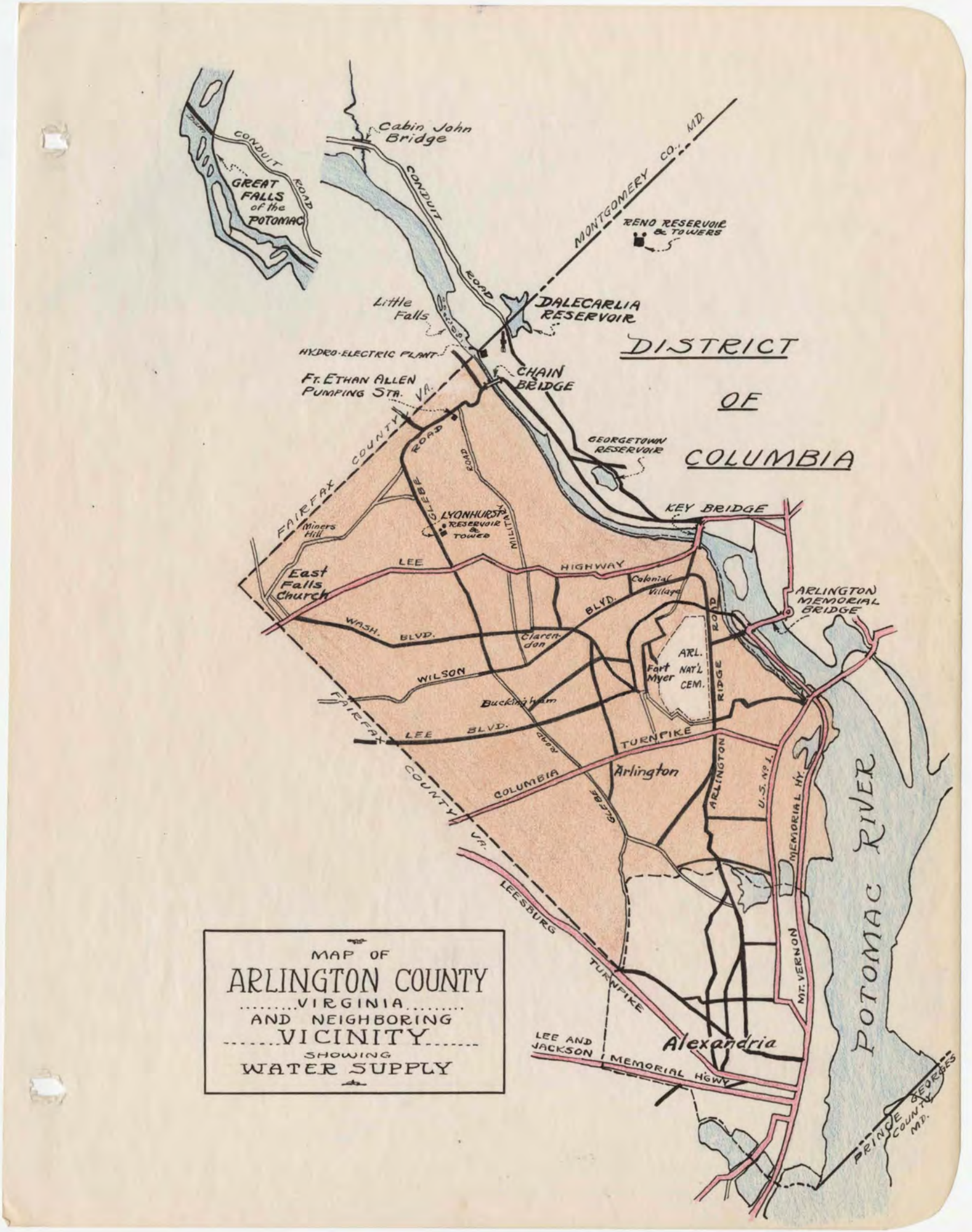
As this program neared completion, officials of Arlington County decided that they would like to buy water from Washington, if they were permitted to do so. A request was made to this effect, and a bill was passed by Congress granting this request. A 24-inch main was placed leading up to Chain Bridge where two 8-inch mains conducted water across the bridge to meet a second 24-inch main on the Virginia side of the Potomac. This work was done by government engineers at the expense of Arlington County.

In the meantime, Arlington County constructed a distribution system, pumping station, and two standpipes. Thus they were ready to meet the pipes laid by government engineers, and water flowed in their system in November of 1927. Since that

time, Arlington County has continued to expand its distribution system rapidly. The most recent addition to the system is the present installation of two 20-inch mains on Chain Bridge which will replace the two original 8-inch mains previously mentioned.

A great many sketches on Arlington's supply have appeared in print in annual reports and newspapers, but these articles have never been complete enough to serve as a general reference. In some cases, they have simply described some detail or incident connected with the work. An immense amount of additional data is available in the files of the United States Engineer Office should more detailed information be desired on any phase of the subject.

This report is divided into three parts: (1) a brief history and description of Arlington County, (2) a review of the development of the Washington Aqueduct, negotiations leading up to the installation of a water system in Arlington County, and its rapid development since that time, and finally (3) an illustrated description tracing the present system from source to consumer.



MAP OF
ARLINGTON COUNTY
.....VIRGINIA.....
AND NEIGHBORING
.....VICINITY.....
SHOWING
WATER SUPPLY

PART ONE

INTRODUCTION

HISTORY OF ARLINGTON COUNTY

The history of the tract of land which is now Arlington County may be said to commence with the establishment of the County of Northumberland in 1649. Previous to that time, this section of Virginia was known as Chickacorn, and was inhabited by the Algonquin Indians. The State of Virginia on December 3, 1789, ceded to the United States the tract of land now known as Arlington County, and it was then a part of the District of Columbia known as Alexandria County of the District of Columbia. In 1846 the citizens of this territory were authorized by Congress to vote in order to determine whether the county should be returned to Virginia, and the referendum showed the people to be in favor of returning. Then later, by an act of the Virginia State Legislature, the name of this county was changed in 1920 from Alexandria County to Arlington County so that confusion with the incorporated independent city of Alexandria might be avoided. The name "Arlington" originates with the name of Henry, Earl of Arlington, who received a grant of land from King Charles II of England of all the land between the Rappahannock and Potomac Rivers.

PHYSICAL DESCRIPTION OF ARLINGTON COUNTY

Arlington County is the smallest county in the State of Virginia, having an area of about twenty nine square miles. It is bounded by Fairfax County and the Potomac River on the north; on the east by the Potomac River; on the south by the city of Alexandria and by Fairfax County; and on the west by Fairfax County and the incorporated town of Falls Church, Virginia.

The topography of this county consists of a rolling plain sloping upward from the Potomac River where the mean elevation is about forty feet, to an elevation of about five-hundred feet at points near the western boundary. Steep bluffs and palisades line the Potomac River from Fairfax County to the Francis Scott Key Bridge, but from here to Alexandria, the river front is very low and level with a sloping shore line. Numerous streams provide good drainage for the county, among which are Pimmitt Run, Windy Run, Long Branch, Donaldson's Run, Spout Run, Gulf Branch, Doctor's Run, and Four Mile Run. None of these, however, provide enough water to be used as a source.

Its population was 16,400 in 1920 and grew to 37,000 by 1930. This great increase during a ten year period shows the extreme need for increasing water facilities to meet the demand of the growing population.

PART TWO

HISTORY AND DEVELOPMENT

HISTORY AND DEVELOPMENT OF THE WATER SUPPLY OF ARLINGTON COUNTY, VIRGINIA

INTRODUCTION

When we speak of the history of Arlington County's water system, it is almost paradoxical in nature. Its water system has just recently been born, and therefore what brief history which might be given should fall in the classification of current events rather than under the heading of history. Similarly, a difficult task is met in finding material which might be called development of the system. Quite opposite from Little Eva, Arlington County's supply did not grow, it was simply born. Growth was not slow in getting started, but almost over night the system suddenly appeared. It was a case of "now it isn't.....now it is."

However, in contrast to this quick development of the transmission and distribution system which furnishes water to all parts of the county, the history of Arlington's supply goes back many years to the days before the Civil War. Arlington's water source appeared when the source of the District of Columbia was constructed. To make this report complete and to give an actual history of the present supply of Arlington County, it would be necessary to review the entire history of the Washington Aqueduct which furnishes water for domestic, business, and industrial needs of the District of Columbia. Arlington County merely buys Potomac River water which is treated in the District and piped into the county. Therefore, the writer of this report feels free to include a brief review of what has happened on the north side of the Potomac in the past hundred years, since it

applies so greatly to Arlington County's present supply of water.

HISTORY AND DEVELOPMENT OF THE SOURCE

A generous supply of ground water of good quality from springs and wells was available for domestic use for the first 50 years of the existence of the City of Washington, D. C., which was created by an Act of Congress on January 4, 1790. Wooden pipes made of bored logs joined together with short wrought iron pipe connection pieces were used to convey water from springs, and these pipes were paid for entirely by the citizens who used the water. When the new Potomac water supply from Washington Aqueduct was turned into the city in 1863, citizens found that it was extremely muddy and that it was good for watering gardens and for fighting fire, but the springs were kept in service for domestic use.

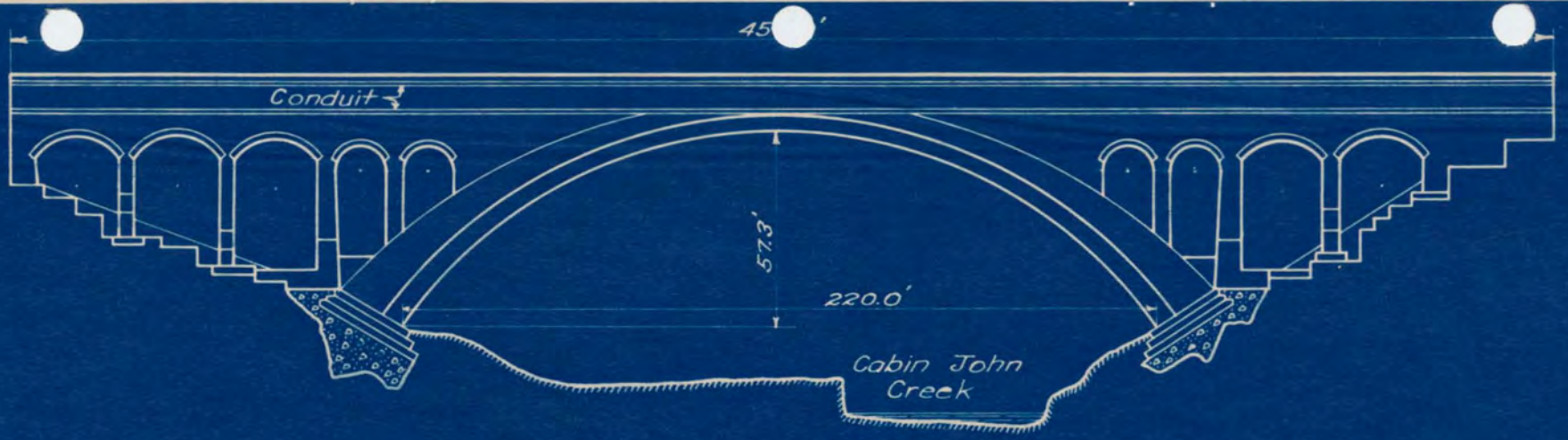
In 1830, Congress determined to take active steps for getting a suitable supply of water for the United States Capitol, and many scenes were proposed, but none were very practical. Then in 1850, Congress appropriated $500 for an examination of the most available mode of supplying the city with pure water. Obviously, this sum was very small and it was followed in 1852 by another appropriation of $5,000 for determining the best means of affording "an unfailing and abundant supply of good and wholesome water." Colonel George W. Hughes of the Corps of topographical Engineers made the first examination, and in his report he stated that the only means of using Great Falls as a source of supply was a large steel or cast iron pipe together with many tunnels. At that time the cost was prohibitive. The second report to Congress, provided for by the $5,000 appropriation was made by Lieutenant Montgomery

C. Meigs of the Corps of Engineers, who afterward was appointed as the first Engineer of the Washington Aqueduct. Trying to foresee the growth of the city water requirements, he planned a 9-foot conduit from Great Falls with a capacity, in his opinion, which would not be reached for almost 200 years. The capacity was reached in less than one third this period, and the present consumption per capita is over twice that of Lieutenant Meigs' estimate, which was then considered an unusually safe figure.

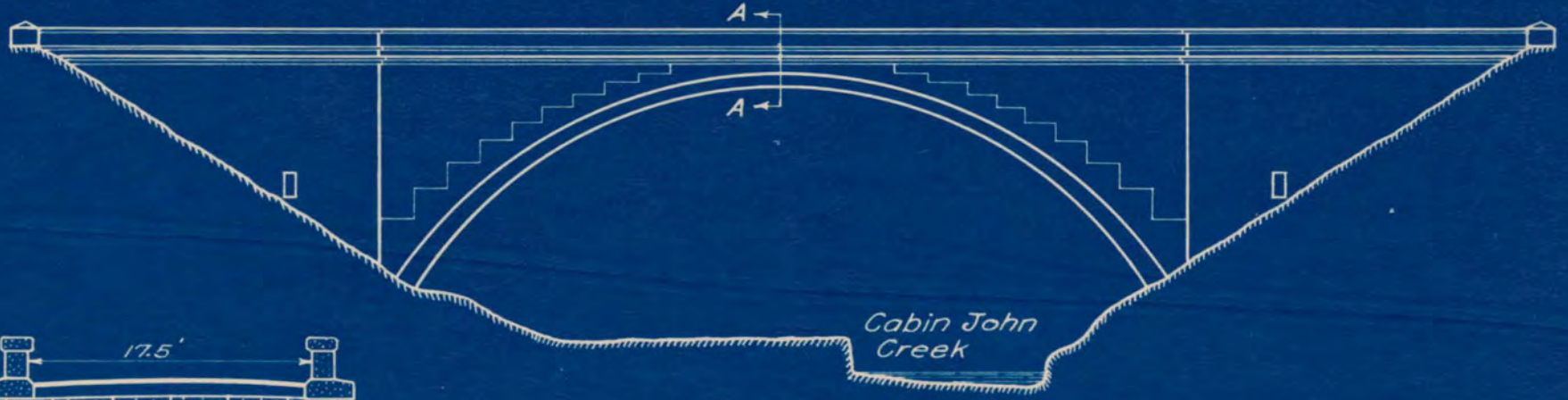
The Great Falls project, called the "Washington Aqueduct", included a dam at Great Falls, a gravity conduit nine feet in diameter, Dalecarlia and Georgetown storage and settling reservoirs, together with various tunnels, bridges, gatehouses, and water mains at a total estimated cost of $2,271,244. After general consideration, Congress adopted the Great Falls project in March of 1853 and appointed Lieutenant Meigs as Engineer of the Washington Aqueduct. Difficulties were encountered and lack of funds completely stopped the work on many occasions. In addition, the Civil War of 1861-1865 caused the postponement of the project, but it was eventually completed, in accordance with the original plans of Meigs in 1863. The lower portion of the aqueduct from Dalecarlia Reservoir to Georgetown Reservoir was completed first, and Meigs decided to supply the city from Little Falls Brook, which at that time discharged directly into Dalecarlia Reservoir. Water was allowed to flow to the city for the first time on January 3, 1859. The gap in the conduit at Cabin John Creek caused a delay of several years in the completion of the work, but water from the Potomac River was first allowed to flow

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY.



LONGITUDINAL SECTION THROUGH CONDUIT



ELEVATION

SECTION A-A
SCALE: 3/32" = 1'

WASHINGTON AQUEDUCT
CABIN JOHN BRIDGE

SCALE: 1" = 50'

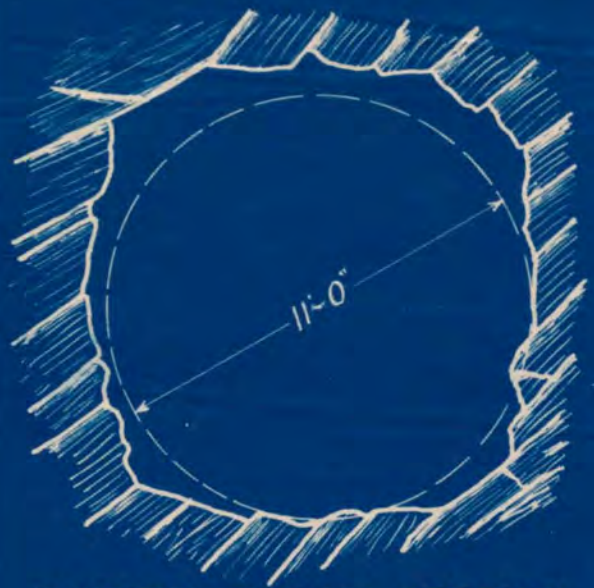
across Cabin John Bridge on December 3, 1863. Shortly after the water system was placed in service, Conduit Road was built above the conduit for a great part of its length.

Actual work on Cabin John Bridge was begun in the spring of 1857, and this imposing granite arch immediately won its reputation as the longest masonry arch in the world and held this record for about 40 years. The main arch of the bridge has a span of 220 feet and a rise of 57¼ feet. At present, the masonry arch at Ploven, Saxony, holds the record with a span of 295.3 feet. A metal lining was installed in Cabin John Bridge in about 1911 and further repairs have not been necessary. Just below the bridge on the south side is the massive concrete structure known as Cabin John Siphon. This is a large concrete covered steel pipe used to convey the new conduit across Cabin John Valley.

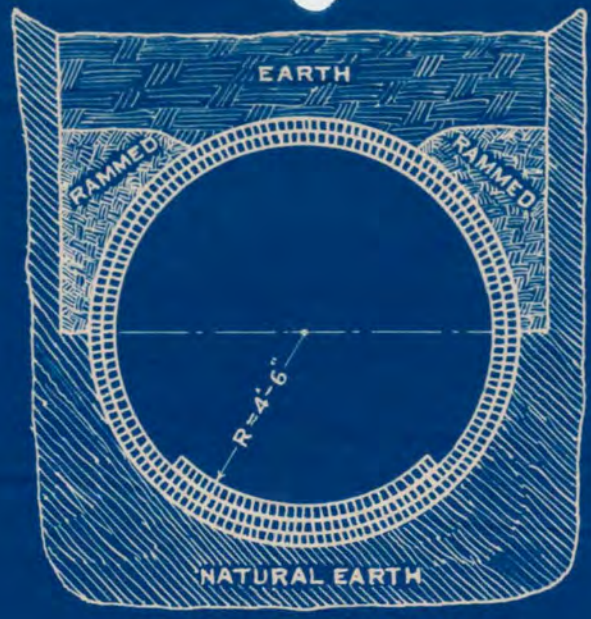
The old conduit stood up remarkably well until an inspection in 1891 which resulted in cleaning the entire conduit in 1895 and 1896. Then, from 1911 to 1918 a few sections of the conduit were lined by emptying the conduit twice a month and working for four-day periods while the reservoirs served the city for those four days. Then work was stopped due to the fact that a new conduit was needed, at which time the old one could be emptied and repaired in an economical manner. In 1925, the new conduit from Great Falls to Dalecarlia was completed and placed in service. It is parallel to the old and only about thirty feet away. Lining the remaining parts of the old conduit in 1927 put it in excellent condition throughout and both conduits seem to be ready for a long period of safe and efficient service.

WAR DEPARTMENT

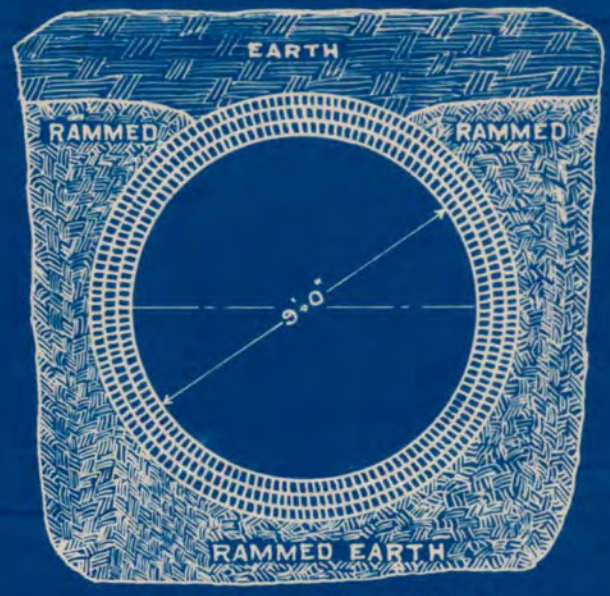
CORPS OF ENGINEERS, U.S. ARMY.



TYPICAL TUNNEL SECTION
As left by Meigs

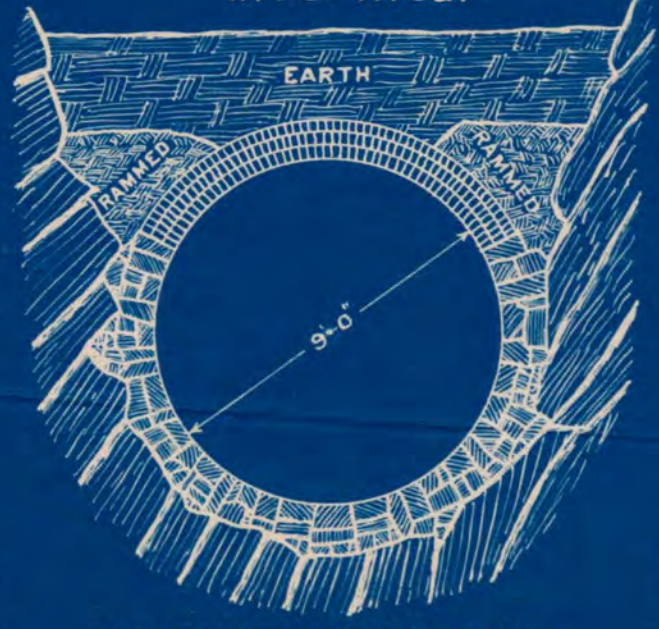


CONDUIT SECTION
In Earth Cut



CONDUIT SECTION
In Fill

1911
TO
TYPICAL CONCRETE LINING-1927



SECTION IN ROCK CUT

Approx. 2700 Lin. Ft. Lined

WASHINGTON AQUEDUCT

SECTIONS-OLD CONDUIT

Scale: 1"=5'

C.P.H.

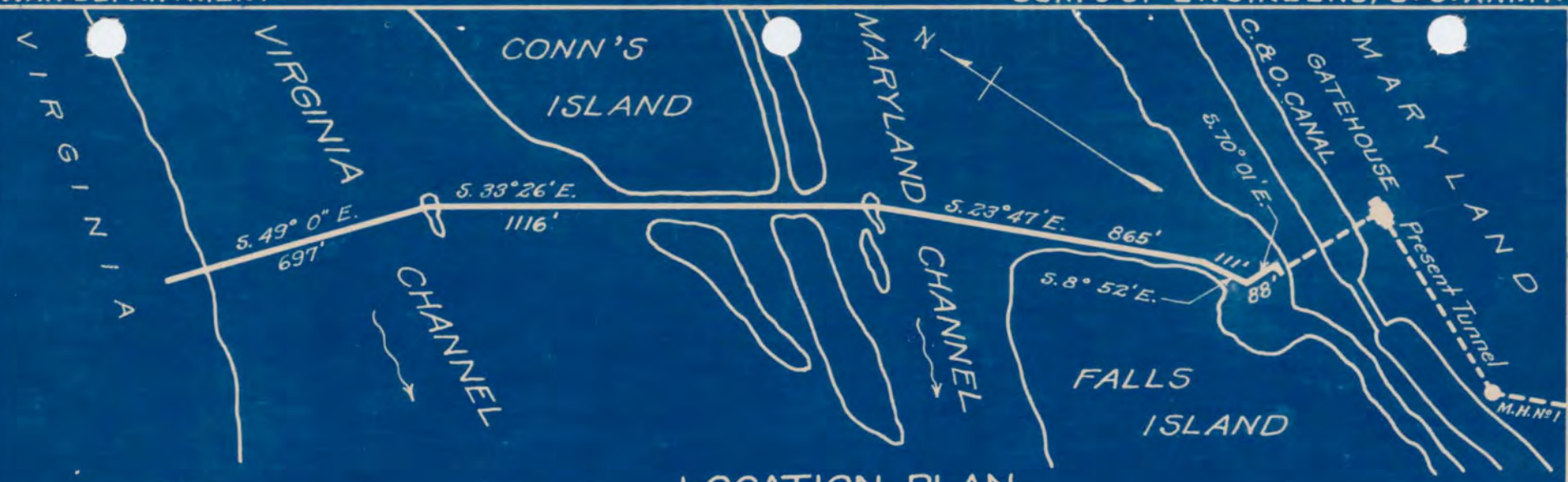
Construction of the dam at Great Falls was accompanied by much delay, litigation, and opposition. Conflicting plans were proposed and several poor attempts at construction were made, resulting in many repairs and much expense. Though original plans for the dam were made in 1853 by Meigs, it was not until 1886 that the dam was extended to the Virginia shore. At many times, it has been repaired and improved by raising its elevation. In its present condition, the structure is 150.5 feet in elevation with flash boards one foot high on the top of the dam. Thus, the dam has every appearance of giving safe and adequate service for many years to come. A hydro-electric plant which was placed in service in 1928 more than doubled the demand of water from Great Falls and was the cause of the installation of the flash boards in 1930.

The record of the 80 years of service of Dalecarlia Reservoir from the time it was constructed in 1858 consists mostly of extensive repairs and alterations. The cost of repairs for those years is well over $400,000 or more than four times the cost of the original structure. One of the most recent additions is the Booster Pumping Station which is located on a dam across the inlet neck of Dalecarlia Reservoir. Its main purpose is to raise the elevation of water on the filters and to increase the rate of flow through the conduits. It is estimated that at present, from 3,000 to 5,000 tons of heavy mud settle out per year at this reservoir and it is dredged out about once every three years.

Dalecarlia Filter Plant was authorized under an act of Congress on June 30, 1921. It was erected by the Corps

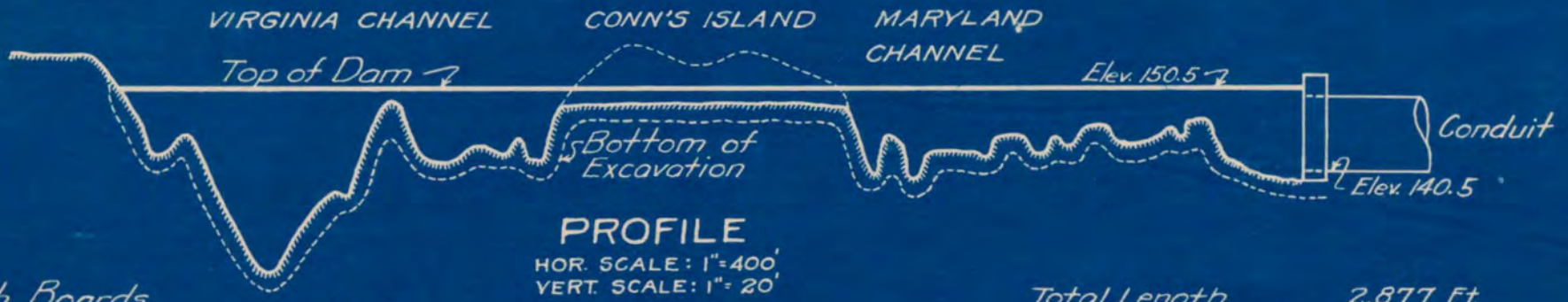
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY.



LOCATION PLAN

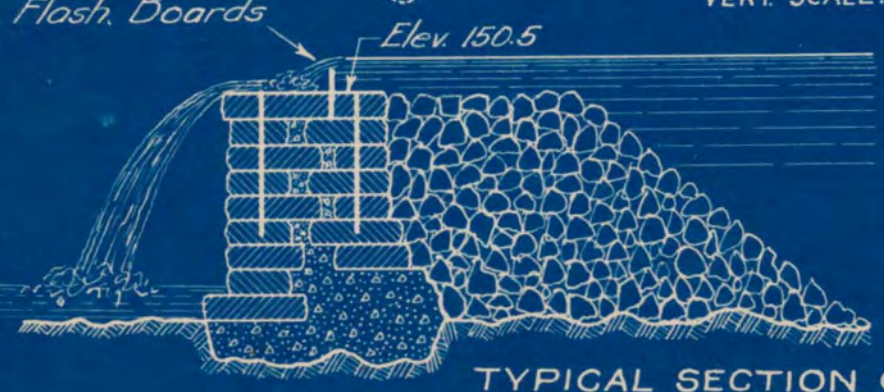
SCALE: 1" = 400'



PROFILE

HOR. SCALE: 1" = 400'
VERT. SCALE: 1" = 20'

Total Length	2,877 Ft.
Maximum Height	24 "
Average Height	13 "



TYPICAL SECTION OF DAM

SCALE: 1" = 10'

WASHINGTON AQUEDUCT

GREAT FALLS DAM

Scale as Indicated

of Engineers of the United States Army from 1921 to 1927 during Washington's "Increasing the Water Supply" program. It was during this period that the new conduit from Great Falls, the hydro-electric plant, the Booster Station at Dalecarlia and several other structures were built.

This extensive program was watched carefully by the Board of Supervisors of Arlington County, who requested that Arlington County be allowed to buy water from Washington. Further developments having direct bearing on Arlington County's distribution system then occurred.

HISTORY AND DEVELOPMENT OF THE DISTRIBUTION SYSTEM

Privately owned shallow wells served Arlington County's residents until recent years. Several attempts to supply water for various sections of the county were made by four independent privately owned systems; namely, Aurora Hills, Virginia Highlands, Bon Air, and Cherrydale Waterworks. These companies were small and served relatively small portions of the county. Cherrydale Waterworks was just recently taken over by the county in October of 1937. The Bon Air system still operates over a small territory. However, nothing was done in a large way to provide water for the rising communities of Arlington County.

Representative Zihlman of Maryland, in 1918, introduced to the House a Resolution to appoint a commission to consider plans for immediately increasing Washington's water supply. He gave as one of his reasons that the federal government expected to have to supply 3,000,000 gallons to surrounding communities and a greatly increased supply to reservations in Virginia. At this time the District furnished Fort Myer 400,000 gallons a

day through a main on the old Aqueduct Bridge now out of existence.

Also in 1918, Secretary of War Baker requested of the Quartermaster General the item of appropriation for the purchase and installation of a 10-inch main across Key Bridge to supply reservations and buildings on the Virginia side of the Potomac River at a cost of $8,100. He pointed out that it was advantageous to install the main in connection with the construction of the bridge. Francis Scott Key Bridge, completed April 21, 1924, replaced Aqueduct Bridge which was about 400 feet ~~north~~ west of present Key Bridge. A single ten inch pipe was installed and carries water to the Army Post at Fort Myer at the present time.

While Washington was engaged in an "Increasing the Water Supply" program, the City Manager and Water Engineer of Arlington County made up their minds, about 1925, to have a water supply. Noting the new filtration plant which was included in this program, they requested that they be allowed to obtain water from the plant. This required an Act of Congress, but the act was put before Congress and approved April 14, 1926. The act was entitled "An act to authorize the Secretary of War to permit the delivery of water from the Washington Aqueduct Pumping Station to the Arlington County Sanitary District." (The Sanitary District of Arlington County was created on March 15, 1922.) The aforementioned act (Public - No. 119 - 69th Congress) authorized the Secretary of War to permit the delivery of water and "to connect the force main of said pumpting station with the water main in Arlington County at the southerly end of Chain Bridge: Provided, That all expense of installing said connections and its appurtenances and any subsequent changes therein shall be borne by said Arlington

County, which shall pay such charges for the use of the water as may be determined from time to time in advance by the Secretary of War.....to be deposited in the Treasury of the United States....."

When this act was approved, the Board of Supervisors of Arlington County made a request to Secretary of War, Dwight F. Davis, for a permit for the delivery of water. A Chief Engineer Mr. A. E. Phillips, was employed for the purpose of installing the system. In the request, E. C. Turnburke, Chairman of the Board, spoke of the "urgent need of improving existing sanitary conditions in this County, where householders' water supply is dependent on individual shallow wells." He also estimated that one million gallons per day would be required, and that this figure would probably double within ten years. This is approximately what happened. The estimated cost for the project was $75,000, and the cost per million gallons delivered was estimated at $65.

Engineers looked forward to the contemplation of a new bridge to replace the Chain Bridge which then existed, and planned to place a 24" main up to the bridge and then to support two 8" pipe lines beneath the floor of the old bridge. This was only temporary, for when the new bridge was built they planned to replace these 8" pipes with one 24" pipe. The contract for laying the pipes was awarded to the Lock Joint Pipe Company of Ampere, New Jersey, whose bid was $50,050.

Work was started on April 25, 1927, and prosecuted energetically until its completion and acceptance by the United States on September 26, 1927. On this latter date, water from Reno Reservoir was turned into the third High Pipe Line to supply

Arlington County. Tests for leakage were run for a period of three consecutive days beginning October 10, 1927, and at the completion of these tests, the water supply for Arlington County was turned on. This occurred at 11:45 A.M. on October 13, 1927.

The total cost of building this system, including work done by the Lock Joint Pipe Company and work done by the government amounted to $71,500 as compared with the original estimate figure of $75,000. The water rate was set at $65 per million gallons beginning September 26, 1927, but was decreased to $55 on January 1, 1929, and again reduced to $50 in 1934.

In June of 1928, less than one year after the completion of the project, Major Brehon Somervell, who was District Engineer during the construction of the Arlington line, wrote a complaint to the Lock Joint Pipe Company, addressing it (intentionally or unintentionally) to the "Leak Joint Pipe Company." He stated, "The Arlington line has been a source of annoyance ever since it was finished and the dirt around it is practically worn out from digging it up and putting it back." The contractor, although legal obligations had been filled, relaid a portion of this main in an effort to correct leakage. It was not necessary to write another letter to the Lock Joint Pipe Company until 1937, at which time it was reported that frequent leakage developed in joints. The contractor again came through and supervised repairs, charging only for the actual cost of materials used. Since that time the mains have been in satisfactory condition.

All the time that pipes were being placed leading up to and over Chain Bridge, Arlington County floated a bond issue and launched

a program of constructing a distribution system. It is reported that the first water main was completed July 2, 1927, and when water was available from the Washington Aqueduct, Arlington County was ready to receive it. Also included in this program of 1927-28 was the construction of a pumping station at Fort Ethan Allen, a steel reservoir at Lyonhurst, and a brick-covered tower at Lyonhurst. In the later months of 1933 a pump was installed at Lyonhurst for the purpose of filling the reservoir and tank. Negotiations were made with the government in 1936 whereby a reciprocal agreement was made with Fort Myer for a temporary supply in case of emergency.

The two 8-inch pipes across old Chain Bridge gave good service for a gradually increasing supply. However when Boy Scouts came from all over the world to a Jamboree in 1937, it was necessary to install a temporary 6-inch pipe to serve a portion of approximately 100,000 boys. The Scouts paid for half of the cost and Arlington paid for the other half on condition that Arlington be allowed to retain the pipe after the scouts left. Within the past few months, the United States Engineer Department has supervised the removal of the old 8-inch pipes from Chain Bridge and has relaid them temporarily on the ground. Two 20-inch pipes hang under the new Chain Bridge and will soon be put into service. This replacement will cost a total of about $46,000. The bridge was designed to carry four 20-inch pipes, two of which will be added when the need requires them.

ARLINGTON COUNTY'S PRESENT SYSTEM

Arlington's system consists entirely of mains with the exception of two structures. Within a few feet of the remaining mounds of what was once Fort Ethan Allen, there is a pumping

station located at Glebe Road and Military Road. This station pumps part of the water which comes into Arlington County, through a 12-inch main to a 1½ M.G. steel reservoir and tower on 25th Street North near Glebe Road, in Lyonhurst. All of these structures were constructed almost overnight in the program of 1927-28.

Eighty-five percent of Arlington County is furnished with water by gravity feed from the Reno Towers, which take care of points over 200 feet in elevation in Washington, D. C. The remaining 15% of the county is divided into two parts according to whether it is served by the steel reservoir or the brick covered tower at Lyonhurst. The reservoir serves those parts which cannot be fed by gravity from Reno, with the exception of points of high elevation in the northern end of the county which must be served by the tower. Even then, a portion of the county, called Miner's Hill cannot be supplied with water with the present facilities due to its elevation, and in order to serve that region an elevated standpipe will be necessary. However, no need is seen to go to that expense just yet for such a small area.

Water enters the County at a pressure of about 180 p.s.i. on the south side of Chain Bridge. A 24-inch main conducts it to Fort Ethan Allen, where it branches into two lines. A 20-inch main runs down Military Road and joins a 12-inch main at Lee Highway. From here, like the branches of a great tree, the system of pipes extends to practically every street in the south, central, and eastern parts of the county. All of this is gravity feed from Reno Towers.

At Fort Ethan Allen, the second branch is a 12-inch line in which water is pumped to the Lyonhurst Station. The reser-

voir furnishes western portions of the county and the tower serves points of highest elevation in the north. All of this system is plainly shown on the large map included at the end of this report.

Since the installation of the system in 1927, great progress has been made in the construction of distributing mains. Consumption has increased quickly and at the same time domestic rates have decreased. (A record of this advancement is tabulated at the end of this report. Also there is included herein a curve showing estimated consumption for the future.) Such growth is partially due to the tremendous rate at which Arlington's population has increased, which in turn is explained by the construction of Memorial Bridge and the beautiful Mount Vernon Memorial Highway. The system is practically new and leakage is low. No trouble is encountered with freezing of mains, because service connections are 4-feet deep. Emergency cross-connections are established with Fort Myer and Falls Church. Thus, the water supply of Arlington County is traced from earliest studies of the Great Falls Project down to the present day.

PART THREE

PRESENT SYSTEM

GREAT FALLS OF THE POTOMAC

The original source of water which supplies Arlington County is the same source which furnishes water to most of the residents of the District of Columbia, namely the Potomac River. The intake is located at a low dam about three-quarters of a mile above Great Falls and is at an elevation of 151.6 feet above mean sea level. The watershed above Great Falls has an area of about 11,050 square miles. The Potomac water is of good quality and has sufficient elevation to flow to the filters by gravity, but artificial treatment is necessary to remove the turbidity and bacteria. Its average turbidity is 140 p.p.m., average hardness 72, and average bacterial count 2500 per c.c.

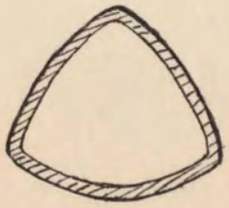
There is approximately a 150-foot fall in 15 miles between Great Falls and tidewater. The average discharge of the river at Great Falls is 7,690 million gallons per day. It has varied from a maximum discharge of 300,000 M.G.D. to a minimum

of 422 M.G.D. The quantity of water at the present source appears to be adequate for all future demands, as may be seen from the table of existing conditions below.

Minimum flow at Great Falls.....422 M.G.D.
Present capacity of supply system.....200 M.G.D.
Average water consumption (D.C. & Arl.Co.).. 75 M.G.D.
Maximum consumption in August 1929.....105 M.G.D.

ENTRANCE TO CONDUITS AT GREAT FALLS

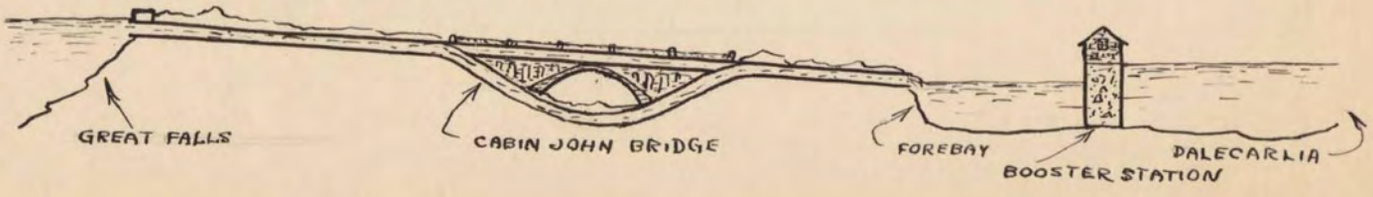
About three-quarters of a mile above Great Falls is the entrance to two huge conduits. The older one is circular in cross-section, nine feet in diameter, and was constructed of brick masonry from 1853 to 1863. The newer one has a cross-section as shown in the sketch below and is of concrete. Its cross-section has an area of 78 square feet, thus being equivalent to a circular conduit nearly ten feet in diameter.



After traveling nine miles through the conduits from the Potomac, water discharges into the forebay of Dalecarlia Reservoir. The conduits together have a total capacity of about 200 M.G.D.

DALECARLIA RESERVOIR

Dalecarlia Reservoir is located at 5900 Conduit Road. Water flows by gravity from an elevation of 151.6 feet above sea level at Great Falls to an elevation of 140.8 feet in the forebay of Dalecarlia. From here it is lifted into the main reservoir at an elevation of 146.3 feet. The booster station which accomplishes this is shown in the background of the photograph at the top of the preceding page. Before going to the plant for treatment, the water has a detention period of about one day in this 210 million gallon reservoir, which allows a sufficient change in velocity and lapse of time to cause a heavy reduction in turbidity at periods of high mud content in the water, which figure will often be as high as 3,000 parts per million of suspended matter by weight. Below is a sketch in elevation of the path taken by the water thus far.



GATEHOUSE AT DALECARLIA

On this gatehouse in the main reservoir at Dalecarlia is inscribed a brief account of the early history of the Washington Aqueduct. This inscription is as follows:

WASHINGTON AQUEDUCT
BUILT BY ORDER OF THE CONGRESS
OF THE UNITED STATES
FOR BRINGING WATER INTO WASHINGTON
BEGUN A. D. 1853 ON THE 8TH DAY OF NOVR.
WATER DELIVERED IN WASHINGTON
FROM THIS RESERVOIR A. D. 1859
ON THE THIRD DAY OF JANUARY
FROM THE POTOMAC RIVER A. D. 1863
ON THE 5TH DAY OF DECEMBER

150 FEET ABOVE O OF THE WASHINGTON AQUEDUCT
150.3 FEET ABOVE ORDINARY HIGHWATER AT WASHINGTON

CAPT. M. C. MEIGS
CHIEF ENGINEER

A. D. 1859

The foreground of the above photograph shows whirlpools above the outlet of the reservoir, from which water goes to the filter plant.

DALECARLIA FILTRATION PLANT

A part of the raw water is drawn from Dalecarlia Reservoir into the filtration plant, and a part is diverted to a hydroelectric plant on the banks of the Potomac. About 120 M.G.D. are used by the hydroelectric plant and 50 to 65 M. G. D. are received by the filters.

As water is drawn from Dalecarlia Reservoir to the filtration plant, through a 6-foot conduit and Venturi meter, a stream of aluminum sulphate is added at the "head house" tower, "A", shown above. To insure thorough intermingling of all the water with the alum, it enters rectangular concrete mixing basins so constructed that the water passes around wooden baffles for a period of 10 to 20 minutes. Then it is conducted through three gates, "B", to two large settling basins, "C", each of which has a capacity of about four million gallons. Three hours are required to pass through, causing a low velocity and giving an opportunity for the aluminum floc to settle out. From the

settling basins the water flows by gravity to 20 filter units, each of which are of 4 M.G.D. capacity. The beds are each 1470 square feet in area, consisting of 18 inches of fine sand resting on 18 inches of graded gravel, ranging from 2-inch to torpedo sand in a series of five layers. This whole mass is supported on a slat bottom or series of 10 x 1 inch closely-laid beams.

Liquid chlorine is applied in split doses, one treatment before water reaches the filter beds and the second, a smaller one, after filtration. Then, as a final step, just enough limewater is added to adjust acidity resulting from previous treatment but not enough to cause boiler scale trouble.

After filtration the turbidity is reduced to zero, hardness remains the same, bacteria is reduced to an average of 2 per c.c., and the water is never exposed to the air again to permit possible pollution until it is delivered to the home of the consumer.

HYDRO-ELECTRIC PLANT

A hydro-electric plant is located 1000 feet away from the filter plant at the foot of a steep bank near the river. Surplus water, which is brought down to Dalecarlia settling and storage reservoir by the two conduits from Great Falls, is carried to the power plant by two 48" mains. The equipment in the power plant consists of 2 vertical 1,500 k.w. Westinghouse generators deliverying 2,200 volt, 3 phase, 60 cycle power. All of the power generated is used in the Dalecarlia Pumping Station and filtration plant. The generators run nine pumps which force water to storage reservoirs in 5 different water service areas of the

District of Columbia. Three of these pumps force water through a 48" main to the Reno towers from which Arlington County receives all of its water by gravity feed. These pumps are 770 H.P. - 2200 V. - 158 amp. - 1200 r.p.m. Westinghouse centrifugal pumps.

RENO RESERVOIR AND ONE TOWER

Inthe foreground, the concrete-covered reservoir may be seen. One of the two towers is also shown here.

RENO RESERVOIR AND TOWERS

The City of Washington is divided into four major districts or pump areas. Part of the city is fed by gravity and the remainder is divided into 1st, 2nd, and 3rd high service, each service being pumped from the Dalecarlia Plant with a reservoir on each area to give the pressure head required. Reno Reservoir of 424 feet elevation is a concrete covered reservoir serving the 3rd high area which is that part between 210 and 280 feet in elevation. All above this is taken care of by the Reno Towers of 485 feet elevation. These are located at 3900 Donaldson Place near the intersection of Wisconsin and Nebraska Avenues, called Tennallytown, in the District of Columbia. All of Arlington County's water comes from these towers by gravity feed. The Tennallytown unit is of sufficient elevation to serve 85% of Arlington County by gravity feed. Two other towers at Lyonhurst, Virginia, are necessary to take care of the remaining 15% not served by gravity from the Reno Towers.

CHAIN BRIDGE

Pipes cross the Potomac River at two places carrying water from Washington into Arlington County. A single 10-inch main conducts water across Key Bridge, but this serves only Fort Myer. A 24-inch main leads up to Chain Bridge where water is conducted through two 8-inch pipes which are at present laid temporarily beside the bridge on the ground. However, two 20-inch mains have been hung underneath the new bridge now under construction, and within a few days of the writing of this thesis, water will travel into Virginia through these new mains to another 24-inch main on the Virginia side of the river.

In the above photograph, the arrow points to one of the new mains, visible as it hangs under the bridge. On the following pages, more detailed views of this interesting improvement are shown. The new Chain Bridge was designed to carry four of these 20-inch mains.

TEMPORARY POSITION OF OLD 8"-PIPES

This shows also the 6-inch pipe added in 1936 to supply additional water required by the Jamboree of Boy Scouts of America.

UNDER THE BRIDGE

One of the newly substituted 20-inch mains is marked by the arrow. The other is hidden in the darker portion of the picture.

CHAIN BRIDGE FROM VIRGINIA

Another view of the mains shows the project under construction.

A CLOSE-UP OF THE 20" MAINS

This photograph was taken from the Virginia side of Chain Bridge.

FORT ETHAN ALLEN PUMPING STATION

Water is transmitted to 85% of the county by gravity from Reno Towers. At Fort Ethan Allen Pumping Station the remainder is forced into a 1.5 M.G. steel reservoir and a brick-covered steel tower at Lyonhurst, from which it is distributed to portions of the county high in elevation.

LYONHURST TOWER AND RESERVOIR

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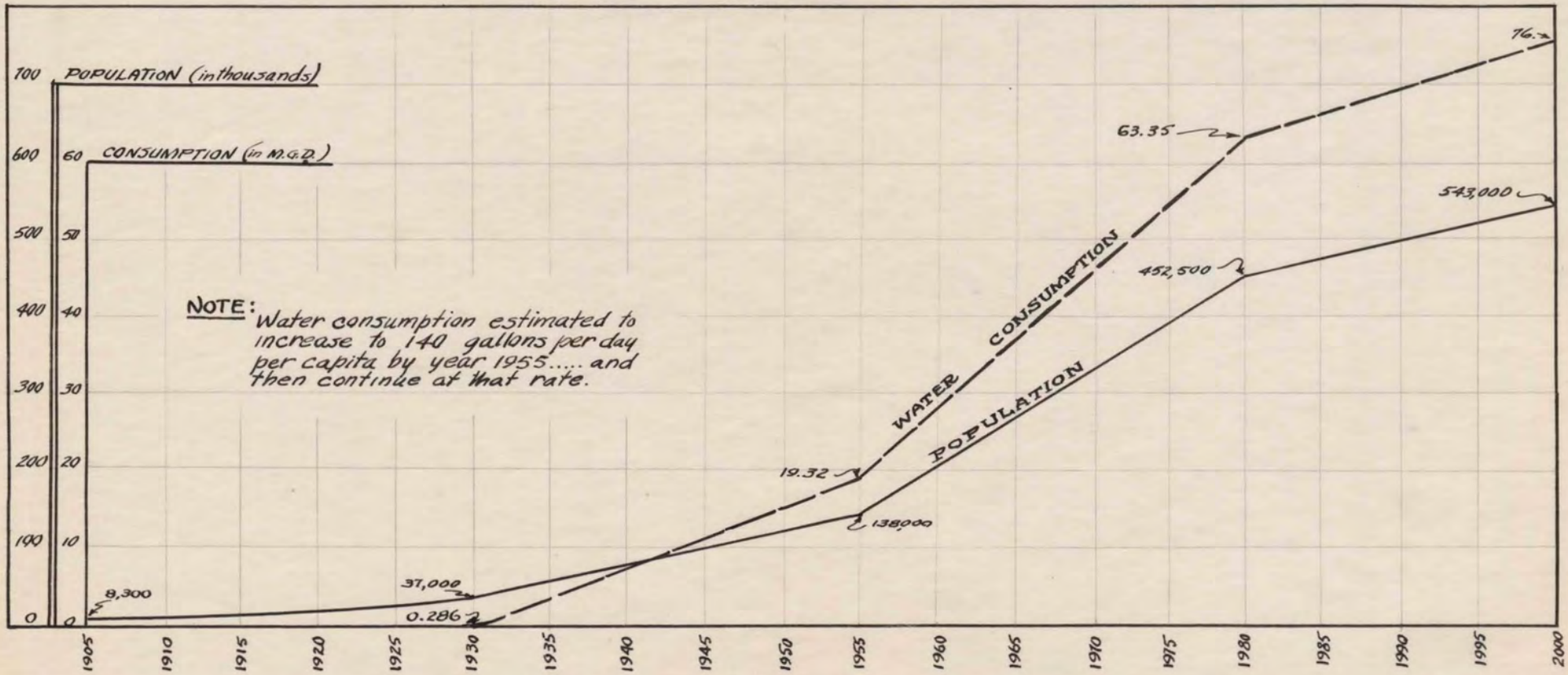
Mr. A. T. Lundberg, Chief Engineer
Water Department , Arlington, Virginia.

Mr. A. J. O'Sullivan, Electrician,
Dalecarlia Filter Plant, Washington, D. C.

Mr. P. O. Macqueen, Senior Engineer
U. S. Engineer Office, Washington, D. C.

THIS TABLE ACCOMPANIED REPORT BY
WASHINGTON REGION WATER SUPPLY COMMITTEE
NATIONAL CAPITOL PARK AND PLANNING COMMISSION
NOV. 1929



ARLINGTON COUNTY
WATER CONSUMPTION & POPULATION
(PAST AND ESTIMATED FUTURE)

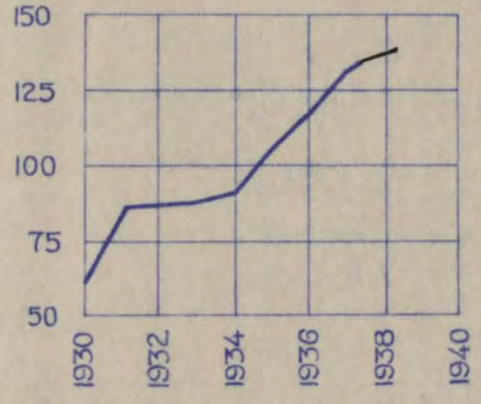
ARLINGTON COUNTY WATER DEPARTMENT ARLINGTON VIRGINIA

STATISTICAL DATA

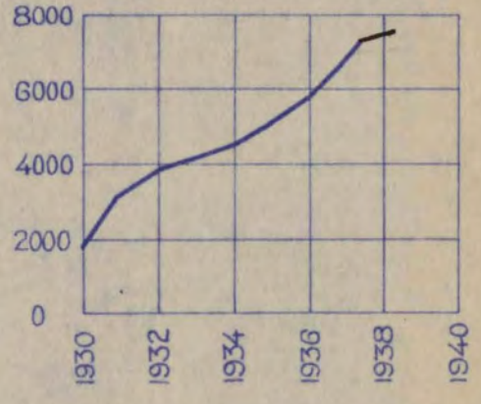
A. T. Lundberg, Chief Engineer

YEAR ENDING	MILES OF WATER MAINS	SERVICE CONNECTIONS	MIN. RATE DOMESTIC PER QUARTER	AVERAGE DAILY CONSUMPTION
JUNE 30, 1930	61.14	1914	6.00	.500(E)
" " 31	83.90	3312	6.00	.640
" " 32	86.76	3878	6.00	.725
" " 33	87.00	4144	5.00	.835
" " 34	91.80	4435	5.00	.932
" " 35	105.43	4997	5.00*	1.093
" " 36	116.00	5887	4.50	1.488
" " 37	130.60	6881	4.50	1.928
FEB 28, 38	136.00(E)	7455	4.50	2.048
" " 39				
JUNE 30 1940				
OCT. 31 1937	133.84	7261	4.50	2.134

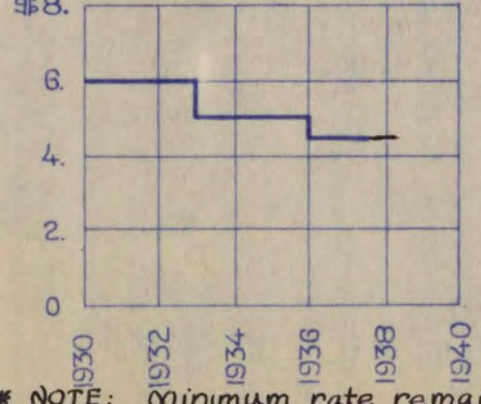
MILES OF MAINS



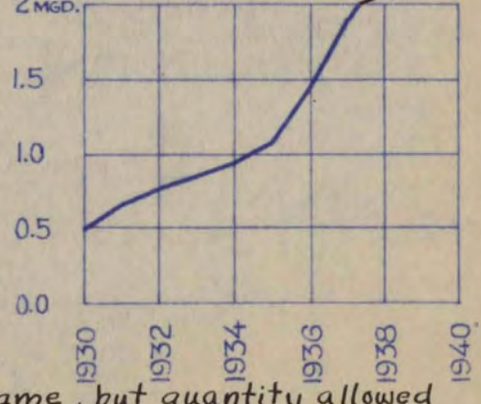
CONSUMERS



QUARTERLY RATE



CONSUMPTION



* NOTE: Minimum rate remained same, but quantity allowed at the minimum rate was increased from 10,000 g. to 12,000 g.

11-10-37